

Thermoacoustic Duplex Technology for Cooling and Powering a Venus Lander, Phase I

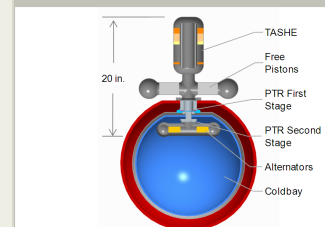
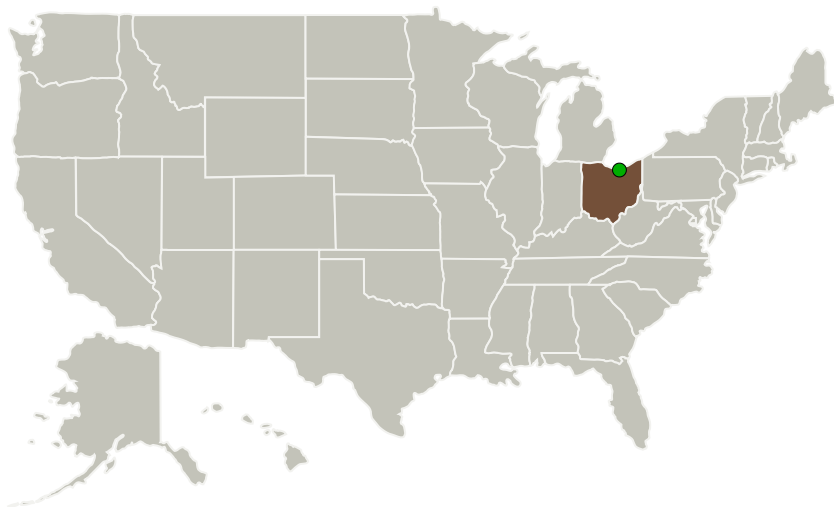
Completed Technology Project (2013 - 2013)



Project Introduction

Sierra Lobo proposes to develop a technology that can provide both cooling and electric power generation using heat. When coupled with a radioisotope heat source, the technology is ideally suited to the needs of a long-lived Venus lander. The heat source powers Sierra Lobo's Thermoacoustic Stirling Heat Engine (TASHE), which is directly coupled to a Pulse Tube Refrigerator (PTR) in a duplex configuration. A linear alternator, also directly coupled, generates electricity. This configuration reduces the number of energy conversion processes and thus maximizes efficiency. The PTR cools a space called the coldbay that houses the linear alternator and scientific instruments. The only moving parts in the system are free pistons that tune the resonant frequency, which operate at Venus-ambient temperature, and the linear alternators that operate near Earth-ambient temperature. The system can potentially be used with the gas from the atmosphere of Venus, which is primarily composed of CO₂, as a working fluid. This provides two key advantages: (1) The system can make the transit to Venus in a low-pressure state, which significantly decreases system mass, and (2) the effect of leakage during operation is minimized, providing confidence in long mission lifetime.

Primary U.S. Work Locations and Key Partners



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Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

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Organizations Performing Work	Role	Type	Location
Sierra Lobo Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations

Ohio

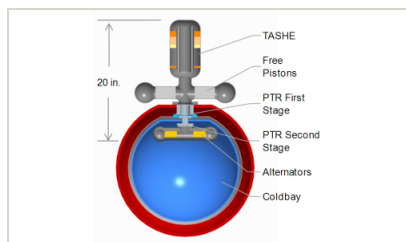
Project Transitions

**May 2013:** Project Start**November 2013:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/139899>)

Images



Project Image

Thermoacoustic Duplex Technology for Cooling and Powering a Venus Lander

(<https://techport.nasa.gov/image/131941>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Sierra Lobo Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

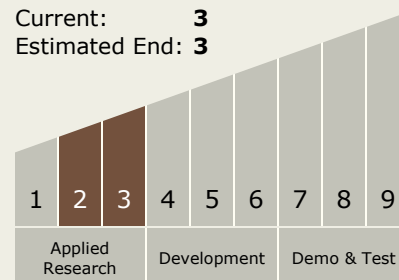
Carlos Torrez

Principal Investigator:

Mark S Habermusch

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - └ TX03.1 Power Generation and Energy Conversion
 - └ TX03.1.2 Heat Sources

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System